

Technology Development for an AC-Multiplexed Calorimeter for ATHENA

Completed Technology Project (2014 - 2016)



Project Introduction

With the recent choice of "The Hot and Energetic Universe" as the theme for the European L2 large mission slot, the ATHENA mission concept is very likely to be chosen for the 2028 launch opportunity. ATHENA will include a high-resolution, imaging spectrometer consisting of a large array of transition-edge sensor (TES) X-ray microcalorimeters. Presently, the U.S. has an active and successful program developing TES calorimeters read out with Time- and Code-domain multiplexing (CDM). In contrast, ESA has invested significantly in frequency-domain multiplexing schemes for TES sensors. Frequency-domain multiplexing requires that the sensors receive an Alternating Current (AC) bias and, so far, AC bias has degraded the energy resolution of X-ray TES sensors by ~50% so that the missions specifications for ATHENA have not yet been met under AC bias. Nonetheless, frequency-domain multiplexing with AC biased sensors may be the baseline plan for ATHENA so there is a clear need for further technology development in this area. To address this need, we propose to improve the performance of small numbers of X-ray TES sensors (one or two) under AC bias in order to meet the mission specifications of ATHENA. We will also design and build Superconducting Quantum Interference Device (SQUID) amplifiers optimized for the read out of many AC biased sensors. Together, these results will boost the Technology Readiness Level (TRL) of AC biased X-ray calorimeters from 3 to 4. These results will significantly strengthen the ability of the U.S. to participate in the planning process for ATHENA and to contribute X-ray calorimeters, SQUID amplifiers, and other components to the spectrometer instrument.

Anticipated Benefits

Decadal Survey Missions



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

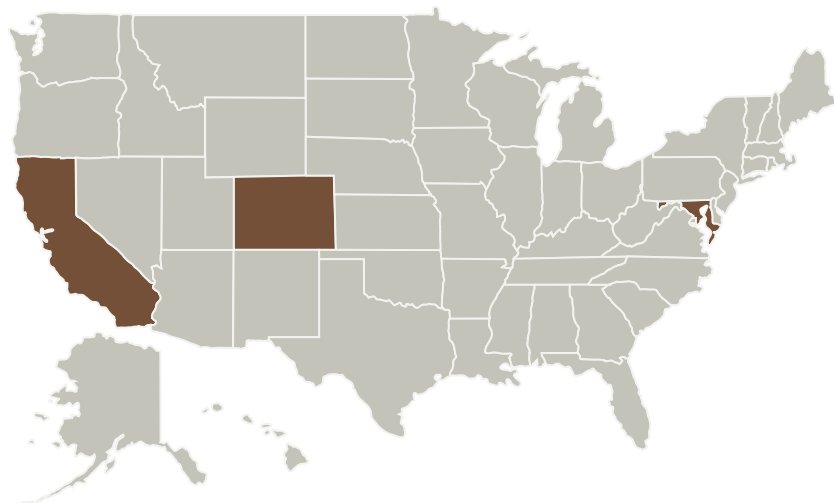
Strategic Astrophysics Technology

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
National Institute of Standards and Technology(NIST)	Supporting Organization	US Government	Boulder, Colorado

Primary U.S. Work Locations	
California	Colorado
Maryland	

Project Management

Program Director:

Mario R Perez

Program Manager:

Mario R Perez

Principal Investigator:

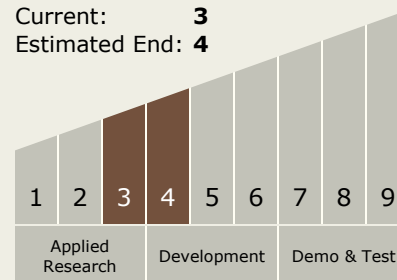
Joel Ullom

Co-Investigators:

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 Joseph S Adams
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Technology Maturity (TRL)

Start: **3**
 Current: **3**
 Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System